

CDOT Construction Manual

SECTION 300 BASES

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SECTION 300

BASES

In terms of structural longevity and riding smoothness, overall pavement quality depends primarily on the quality and uniformity of the material layers constructed under the surface course. Subgrade, subbase, and base course materials must meet specified requirements and must be properly and uniformly prepared, placed and compacted to adequately support the loads of vehicular traffic. Deficiencies in subgrade, subbase, and base course construction will invariably degrade the riding surface and cause a need for premature rehabilitation.

300.1 SUBGRADE PREPARATION

Section 203 discusses roadbed excavation and embankment construction. The resulting subgrade is the primary foundation of the total pavement structure; therefore, its construction should be closely monitored. Examine the subgrade for soft spots, ruts, and grade deficiencies. Such deficiencies must be corrected in accordance with the provisions of the Contract. Consider the following general guidelines:

1. Low Areas. Low areas should be filled with a suitable subgrade material, regraded, and compacted to target density. Pay particular attention to areas such as ruts. If not filled and compacted with subgrade material, ruts will invariably be filled with base material, and most compaction equipment will bridge over ruts. This bridging effect creates areas that will fail to meet specified uniform density requirements.
2. High Areas. Pay particular attention to rocky areas above grade. It is unacceptable practice to scalp these areas and reuse the resulting rocky material to fill low spots further ahead in station. The rocky material produced by the scalping operation will be poorly graded and will promote pavement failure. Rather, these areas should be scarified to a depth sufficient to accommodate the required compacted thickness of approved base course material.

3. Moisture Content. Pay particular attention to the moisture content of the subgrade material placed for compaction. Uniform compaction to target density is critical but will not be achieved if the material is either too wet or too dry.

See Section 306 and Section 307 for additional information on subgrade reconditioning and treatment.

300.2 BASE COURSE CONSTRUCTION

The base course, or subbase if specified, is a layer of material (e.g., bituminous mix, aggregate) that is placed, graded, and compacted on top of the subgrade. Depending on the requirements of the Contract Plans, more than one layer of base course material may be required. The base course provides the pavement structure with a free-draining, non-frost-susceptible material layer that distributes the traffic load from the surface course to the underlying subgrade. Because the base course lies directly beneath the surface course, it is critical that construction parameters be tightly controlled. Consider the following general guidelines:

1. Material Considerations. Check to ensure that the base course material meets the requirements of the Contract Specifications in terms of type, gradation, and uniformity. Reject substandard material based on the provisions of the Contract.
2. Thickness. Where applicable, lift thickness must not exceed the maximum specified for the material being placed. Verify the total compacted thickness of the base course with that specified in the typical sections of the Contract Plans.
3. Density. Check that the material is uniformly compacted to target density. Moisture content greatly affects material consolidation and should be monitored as required. Areas that fail to meet specified requirements must be reworked, compacted, and verified for compliance.

4. Grade and Surface Tolerance. To ensure a smooth riding surface and a uniform depth of surface course material, the final grade and cross-section of the base course must be within allowable tolerance. It is unacceptable to adjust the thickness of the surface course for the purpose of making final adjustments to grade and cross-section.

See Section 301 and Section 304 for additional information on plant-mix bituminous base and aggregate base course construction.

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SECTION 301

PLANT-MIX BITUMINOUS BASE COURSE

301.1 GENERAL

Plant-mix bituminous base course is a mixture of aggregate and bituminous materials that is mixed at a central plant, hauled, placed, and compacted as a base course for the pavement structure. See Section 300.2 for additional information.

301.2 INSPECTION GUIDELINES

301.2.1 Before Construction

Before construction of the plant-mix bituminous base course begins, consider the following:

1. Contract Plans and Specifications. Review the Contract. Specifically note the required cross-sectional elements (e.g., width, thickness, cross slope). Check the *Project Special Provisions* for any changes to the Method of Measurement or Basis of Payment.
2. Material Requirements. Become familiar with the material requirements of the Contract Specifications (e.g., job-mix formula, gradation requirements) and the related tests and acceptance criteria. Gradation requirements, in particular, may change on a project-to-project basis.
3. Scale/Weigher Certification. Check to ensure that the commercial scale and weigher have been properly certified.
4. Load Restrictions. Become familiar with the load restrictions on public facilities. See Appendix D for applicable legal weight limits.

5. Equipment. Gather the necessary inspection equipment and be prepared to check mix temperature and the depth and surface tolerance of the base course. Ensure that the Contractor has on hand the proper placement and compaction equipment.
6. Spread Yield. Review and understand how to check spread yield for placed base course material. For instructions on calculating spread yields and yield factors, see the example in Appendix B for Form 282 – Asphalt Paving Inspector Daily Report.
7. Subgrade/Subbase. Ensure that the cross slope, elevation, and alignment are correct. Visually inspect the subgrade/subbase for soft spots, ruts, and grade deficiencies. Ensure that the subgrade/subbase is prepared within allowable tolerance to properly receive the required thickness of base course material. See Section 300.1 for additional information.

301.2.2 During Construction

The construction of plant-mix bituminous base course is effectively governed by subsections 401.07 through 401.19 of the *Standard Specifications* for plant-mix bituminous pavements. See Section 401 of this *Manual* for construction inspection guidance and consider the following:

1. Load Tickets. Do not accept any load of material without receipt of a properly completed and validated load ticket. Do not accept or sign a load ticket unless the load was actually placed as specified. Do not accept load tickets from overweight haul vehicles.
2. Mix Temperature. Check the mix temperature at the required sampling frequency.
3. Weather Limitations. Check weather forecasts and verify that the operation is being performed within the limits of the Contract Specifications with regard to cold weather paving and inclement weather. Do not allow the operation to continue during rain or when the subgrade/subbase is too wet or frozen.

4. Placement. Observe the material being placed for obvious signs of degradation (e.g., segregation, foreign material). Take measurements as needed to ensure that the material is being placed to the required width and depth. Check and document yield frequently.
5. Compaction. Observe the compaction operation for obvious signs of improper operation. Check density at the required sampling frequency to be certain that the Contractor is uniformly obtaining the specified target density.

301.2.3 After Construction

Check the cross-section (e.g., cross slope, thickness, elevation) as needed to ensure that the final compacted base is within the limits of the Contract Specifications.

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SECTION 304

AGGREGATE BASE COURSE

304.1 GENERAL

Aggregate base course is a graded aggregate material that is hauled, placed, and compacted as a base course for the pavement structure. See Section 300.2 for additional information.

304.2 INSPECTION GUIDELINES

304.2.1 Before Construction

Before construction of the aggregate base course begins, consider the following:

1. Contract Plans and Specifications. Review the Contract. Specifically note the allowable lift thickness, total required depth, and cross slope required. Check the *Project Special Provisions* for any changes to the Method of Measurement or Basis of Payment.
2. Material Requirements. Become familiar with the material requirements of the Contract Specifications (e.g., gradation requirements) and the related tests and acceptance criteria. Gradation requirements, in particular, may change on a project-to-project basis.
3. Scale/Weigher Certification (Tonnage Basis). Check to ensure that the commercial scale and weigher have been properly certified.
4. Load Restrictions. Become familiar with the load restrictions on public facilities. See Appendix D for applicable legal weight limits.

5. Equipment. Gather the necessary inspection equipment and be prepared to check lift thickness, total depth, and surface tolerance.
6. Spread Yield. Review and fully understand how to check the spread yield for placed base course material. For instructions on calculating spread yields and yield factors, see the example in Appendix B for Form 282 – Asphalt Paving Inspector Daily Report.
7. Subgrade/Subbase. Ensure that the cross slope, elevation, and alignment are correct. Visually inspect the subgrade/subbase for soft spots, ruts, and grade deficiencies. Ensure that the subgrade/subbase is prepared within allowable tolerance to properly receive the required thickness of base course material. See Section 300.1 for additional information.
8. Staking. Spot check and verify that width and thickness have been properly staked.
9. Soil Survey. In areas where the subgrade may provide an unusually stable foundation (e.g., rocky areas), consider requesting a soil survey to determine if the total thickness of the aggregate base course can be effectively reduced without compromising the integrity of the pavement structure.

304.2.2 During Construction

Consider the following guidelines when inspecting the construction of aggregate base course:

1. Load Tickets (Tonnage Basis). Do not accept any load of material without receipt of a properly completed and validated load ticket. Do not accept or sign a load ticket unless the load was actually placed as specified. Do not accept load tickets from overweight haul vehicles.
2. Material Quality. Verify that the material delivered meets specified criteria with regard to gradation requirements, and ensure that samples are tested at the

required frequency. Poorly graded, oversize, and contaminated material (e.g., balls of clay) are grounds for rejection.

3. Placement. Verify the uniformity of the aggregate material. Observe the material as it is placed and spread for obvious signs of degradation (e.g., segregation, foreign material, mixing with subgrade material). Take measurements, as needed, to verify placement to the required width and depth. Check yield frequently to verify actual quantities.
4. Compaction. Observe the compaction operation for obvious signs of improper operation. Each lift must be uniformly compacted to the target density before subsequent lifts are placed. To ensure optimum density, verify the proper application of water before compaction.
5. Surface Tolerance. Check the cross-section (e.g., cross slope, thickness, elevation), as needed, to ensure that the final compacted base is within the limits of the Contract Specifications.

304.2.3 After Construction

Check that the surface is satisfactorily maintained until the next course (e.g., surface course) is ready to be placed.

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SECTION 306

RECONDITIONING

306.1 GENERAL

Reconditioning is the preparation of a specified depth of the top layer of the existing subgrade. This work is generally performed by blading, watering, and compacting. The moisture content of the in situ material is critical during compaction to achieving target density.

306.2 INSPECTION GUIDELINES

306.2.1 Before Construction

Before reconditioning of subgrade material begins, consider the following:

1. Contract Plans and Specifications. Review the Contract. Specifically note the required cross-sectional elements (e.g., width, depth of thickness, cross slope). Specified surface tolerance may change on a project-to-project basis, especially where surface materials are to be placed directly on the reconditioned subgrade.
2. Equipment. Gather the necessary inspection equipment and be prepared to check depth of treatment and surface tolerance.
3. Staking. Spot check and verify that the correct lines and grades have been staked.

306.2.2 During Construction

Consider the following guidelines when inspecting the reconditioning of subgrade material:

1. Blading. Check the depth of treatment for conformance. To ensure that the proper quantity of water is being added to the subgrade material, periodically verify the moisture content with the Project Laboratory, especially in areas suspect of being too wet or too dry.
2. Compaction. Observe the compaction operation for obvious signs of failure. Visually inspect the subgrade for soft spots and other unacceptable deficiencies.
3. Surface Tolerance. Check the surface tolerance frequently for conformance to the Contract Specifications.

306.2.3 After Construction

Check that the surface is satisfactorily maintained until the next course (e.g., base course) is ready to be placed.

SECTION 307

LIME-TREATED SUBGRADE

307.1 GENERAL

Hydrated lime is typically added to the in situ subgrade material to improve its physical characteristics as a foundation. The required quantities of lime and water are determined through preliminary sampling and testing of the soil. Application rates typically are specified in the Contract Plans, but may be provided by the Project Engineer. The Contract Plans also will designate the depth and width of treatment.

307.2 INSPECTION GUIDELINES

307.2.1 Before Construction

Before work on the subgrade begins, consider the following:

1. Contract Plans and Specifications. Review the Contract. Specifically note the number of courses, depth of treatment, and required cross-sectional tolerance. Check for any changes in the Method of Measurement or Basis of Payment.
2. Material Requirements. Become familiar with the material and processing requirements of the Contract Specifications (e.g., slurry mixing) and the related tests and acceptance criteria.
3. Scale/Weigher Certification. Check to ensure that the commercial scale and weigher have been properly certified.
4. Load Restrictions. Become familiar with the load restrictions on public facilities. See Appendix D for applicable legal weight limits.

5. Equipment. Gather the necessary inspection equipment and be prepared to check depth of treatment and surface tolerance.
6. Application Rate. Review and fully understand how to effectively determine and verify lime and water quantities and the rate of application of lime slurry for the required width and depth of treatment.
7. Hazards. Become familiar with the hazard potential and first-aid requirements of bodily contact with lime.

307.2.2 During Construction

Consider the following guidelines when inspecting the construction of lime-treated subgrade:

1. Preparation. Ensure that the subgrade has been properly prepared and that the cross-section, elevation, and alignment are correct. Visually inspect the subgrade for soft spots, ruts, and grade deficiencies. See Section 300.1 for additional information. Where scarification is required, verify that the maximum depth of loosened material is not exceeded.
2. Load Tickets. Do not accept any load of material without receipt of a properly completed and validated load ticket. Do not accept or sign a load ticket unless the material was applied as specified. Do not accept load tickets from overweight haul vehicles.
3. Material Quality. Verify that the material delivered meets specified criteria and ensure that sampling and tests are performed at the required frequency. Reject loads based on the provisions of the Contract.
4. Weather Limitations. Check weather forecasts and verify that the operation is being performed within the limits of the Contract Specifications with regard to cold and inclement weather. Do not allow the operation to continue when the subgrade material is too wet or frozen.

5. Application Rate. Check the quantities of lime and water, as needed, to verify that the proper proportions are being used. Periodically verify that the rate of application is as specified in the Contract.
6. Mixing. The initial mixing operation must follow immediately behind the application of the lime slurry. Check that the lime slurry, water, and scarified soil are being thoroughly mixed to the required width and depth. Residual lime, clods, lumps, and foreign matter are unacceptable. Several passes may be necessary before final mixing. Based on the results of field tests, ensure that the optimum moisture content is attained before compaction. Additional water may be required.
7. Compaction. Observe the compaction operation for obvious signs of improper operation. Verify that the target density is being obtained. Pay particular attention to the density obtained near edges and joints.
8. Surface Tolerance. Check the cross-section (e.g., cross-slope, thickness, elevation) as needed to ensure that the final compacted subgrade is within the limits of the Contract Specifications.
9. Construction Joints. Construction joints may be required based on the time elapsed between work on adjacent sections. Check the specific requirements of the Contract.
10. Curing. Check that the method of curing conforms to specified requirements. Unless an overlying seal or base course is applied, the treated subgrade is typically sprinkled with water. Ensure that the Contractor corrects any surface damage to the final treated subgrade and that subsequent pavement courses are not prematurely placed.

307.2.3 After Construction

Check that the surface is satisfactorily maintained until the next course (e.g., base course) is ready to be placed.

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